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Master's Thesis  
Academic Year 2021

Hello Shadow: A Platform to Foster Interaction  
between People in Remote Communication by  
Utilizing Shadow



Keio University  
Graduate School of Media Design  
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A Master's Thesis  
submitted to Keio University Graduate School of Media Design  
in partial fulfillment of the requirements for the degree of  
Master of Media Design

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Abstract of Master's Thesis of Academic Year 2021

# Hello Shadow: A Platform to Foster Interaction between People in Remote Communication by Utilizing Shadow

Category: Design

## Summary

This research explores the potentiality of shadow as a media communication. Shadow delivers very limited information about the person's appearance while still effective to deliver the certain body information. The value of shadow express the feeling of presence in interaction between people.

Hello Shadow aims to utilize the value of shadow to foster interaction between people in remote communication. Designing a communication method of ambiguous gestural exchanges through shadow visuals. Several related study were mentioned to support the research hypothesis. This research conducted a preliminary user study to evaluate user reaction to the prototype of Hello Shadow. According to the evaluation experiment, the method of Hello Shadow is promising to tackle the challenge people having when interacting with strangers at the first time. The experiment shows that the interaction via shadow visual could facilitate awkward free interaction and offering conversation enjoyment in remote communication.

## Keywords:

shadow, remote communication, strangers, gesture-based communication, anonymous communication

Keio University Graduate School of Media Design

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# Chapter 1

## Introduction

### 1.1. Background

Remote communication has become a part of life these days. Transitioning to a new normal due to prolonged pandemic, people limit mobility and keep social distancing. More people are using remote communication platforms for work, build connection, and make a relationship.

For some individuals, interacting with new people can be challenging in remote communication. One of the challenges is feeling afraid of talking with strangers. Some people may believe that the interaction will not going to be enjoyable for them and for the strangers [3]. Another challenge is that people do not know how they would carry the interaction. They may feel awkward for the first time talking with stranger. How to foster interaction between strangers in remote communication? For some extent, being anonymous may help. Besides, there is a need to use a creative medium to tackle those challenges.

Shadow is one of the media that can be used in remote communication. Some studies have shown that shadow has certain values for media communication. Some values such as express people's existence while limiting the appearance, facilitate the sense of connection, and embrace the gestural exchange in communication. By utilizing ambiguity and anonymously of shadow, interacting with new people may be a new unique experience.

### 1.2. Remote Communication These Days

Nowadays, people are using remote communication more than ever. The pandemic set up a new normal trend of interaction between people. The way of new normal communication not only happening right now, bus possibly in the future. A

survey by Gallup poll found that 43% of Americans had spent at least some time working remotely. [4] Remote working trend consequently affecting the way people communicate. Such condition also proved by the Google Trends. According to what people search of "remote communication" in the past five year.

The trends tend to bring some light for the remote communication services. For instance Omegle. Omegle is a remote communication platform that facilitate people to interact with strangers via video and chat features. According to Google Trends, Omegle have constantly gaining the hype during the pandemic situation. The trends shows that people are isolated and connecting with new people may overcome their boredom. Many studies found that interacting with strangers gave happiness as the same boost that being helpful does.

However, for some people connecting with strangers in remote communication is difficult. The online interaction tends to bring a challenge in fostering interaction between people since the interaction is virtual. Remote communication is missing the cues humans use when they interact. (Blank, 2020). Another possibilities is people tend to be distracted by their insecurity. The virtual interaction somehow facilitates people to check their appearance more frequently through the video screen.

### 1.3. Contribution

This research explores the way to promote interaction between people in remote communication. This research believe in the potentiality of shadow as a media communication. Shadow delivers very limited information about the person's appearance while still effective to deliver the certain body information. The value of shadow express the feeling of presence in interaction between people

The ambition of this research is to propose a unique communication experience using shadow for anonymous strangers. Communication is commonly considered as the activity of exchanging information. However this research proposed completely ambiguous communication method via gestural exchange through shadow visuals. Shadow has certain value in creating the connection between people through the physical embodiment channel.

## 1.4. Thesis organization

This thesis consists of five chapters.

- **Chapter 1** describes the background and the contribution of this research.
- **Chapter 2** mentioned the three foundations of this research: Shadow communication, anonymous interaction, gestural communication.
- **Chapter 3** describe the concept design, the design process, the key elements of the design, and the prototype.
- **Chapter 4** validates the prototype through experimentation and discussion.
- **Chapter 5** consist of the summary and the future development of this research

# Chapter 2

## Literature Review

In tackling the challenges of interaction between strangers in remote communication, this research believes in the value of shadow as a creative medium that could promote social interaction. Shadow has certain value in delivering limited information of people's appearance but still effective to deliver certain body information. The value of shadow will express the feeling of presence without showing people's physical appearance. In this research context, this values could tackle the challenges of fear to interact with strangers in remote communication. There are related research that prove the potential of shadow. Moreover, since the research aim to utilize the ambiguity of shadow, related works about gesture-based communication were examine. Besides, this research examined the advantage of anonymity in social interaction. As a result , the three elements that could foster interaction between strangers in remote communication were defined.

### 2.1. Shadow

Shadow is a natural phenomenon reflecting an object's physical presence but not its appearance. The value of shadow has inspired various works from performance, entertainment, art, as well as communication.

Shadow performance is one of the example of shadow in entertainment context. More than 20 countries are known to have shadow performance culture [5]. In Indonesia there is shadow puppet performance named Wayang. In Wayang shadow performance we can watch the shadow puppet appear to walk, dance, and fight.

In the media art field, there are several research exploring the shadow visualization, transforming shadow into immersive display. For instance Movie-in-Shadow by Minomo et al. which created system to translate people shadow into color-

ful video display. Then, Graphic Shadow by Kato et al. [6], Fragment Shadow by Kasahara et al. [7] explores shadow visualization into textured and pictorial shadow.

Another interesting research inspired by shadow is Interaction with Virtual Shadow through Real Shadow using Two Projectors by Iwasaki et al. 2016 [8]. The system was aim to bridge the connection between in real world and the digital world. Enabling people to interact with the projection of virtual shadow using their real shadow. From the experiment, participants could experience the shadow connection while encouraging self expression through shadow visuals.

According to the studies mentioned above, the transformation of real shadow into another visual display offers unique experience of body sensation. Moreover, such explorations offers interactive experience for people to play with the space surroundings through gestural expression.

### **Shadow as a Medium of Interaction Between People**

Researches prove the potentiality of shadow as a medium of interaction between people. Shadow Communication, explored the value of shadow that could express people's existence and could create same stage of communication [1]. VideoWhite-Board by Tang et al. utilize shadow to create collaborative drawing experience between two people [2].

The Shadow Communication facilitates people to interact with their partner's shadow without seeing their partner's appearance. The experiment studies the interaction between people in separated location. Two separated rooms were constructed to make the interaction possible. The rooms consist of projectors, thermal vision cameras, semi-transparent screens as well as mic and speaker. The experiment's participant were allowed to interact and speak freely. According to the experiments, participant in separated rooms could sensed the presence of their partner even though its only their partner's shadow. The experiment found that the participant were easily to synchronize their body movement with their partner. Beside, the experiment finds that shadow could create a same stage of communication. The participant mentioned several comments related to shadow's potential in creating same stage of communication. Some of the participant feel that the communication method makes them feel easy to speak, they feel no

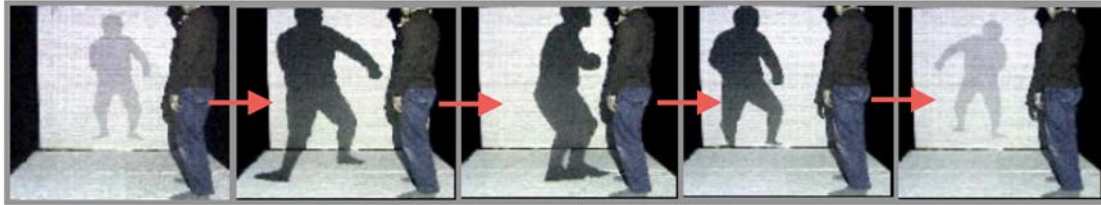


Figure 2.1 Shadow Communication by Miwa et al. [1]

tension.

Another study is VideoWhiteBoard. VideoWhiteBoard enables people to draw together from separated location while feel the existence of their partners. The existence were provided by their partners shadow projection. The shadow are projected onto the drawing space by using video cameras and video projectors. The drawing experience allows the participants to draw together while observing each other's gesture. The study shown that the participants feel like their partners is located on the other side of the screen instead of in separated location.

Several works also approaching the online interaction without showing people's real appearance. For instance Loomie!. Loomie! is a 3D video chat avatars [9]. Loomie! enables people to translate their appearance into 3D avatar for video chatting activities. User only have to take a potrait of them selves, then the system will translate the potrait into 3D avatar. The 3D avatar is mimicking the people's facial expressions. Moreover, user could choose their 3D avatar appearance. Loomie! also facilitate user to modify their 3D avatar. Loomie! could be integrated with several video conference service which be helpful for user to use it. By creating such experience, Loomie! aims to spark the interaction in remote communication between people.

Even though providing 3D avatar also encourage meaningful interaction without showing real appearance, this research believe the uniqueness of shadow visual as a medium. As mentioned above, several studies has been prove that shadow could

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3 source: <https://www.forbes.com/sites/charliefink/2020/09/18/how-loomie-avatars-augment-video-calls/> accessed on July 27, 2021

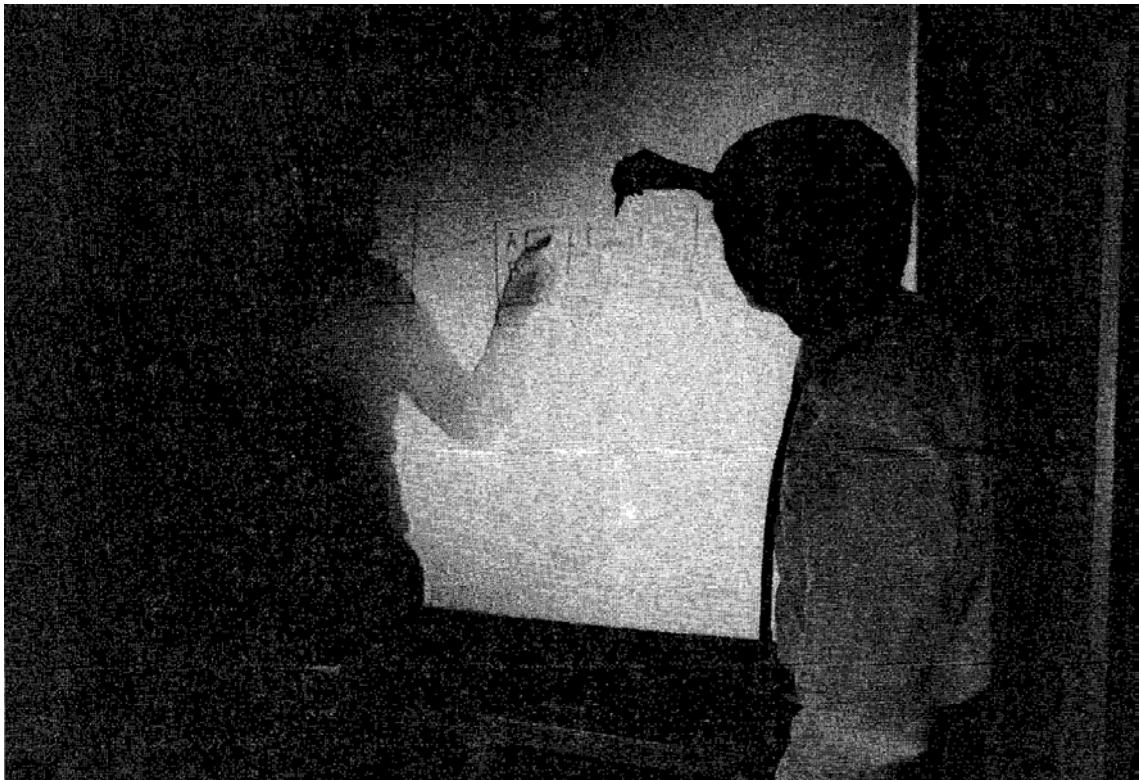


Figure 2.2 Video White Board by Tang et al. [2]



Figure 2.3 Loomie! 3D video chat avatars experiences. Credits: Charlie Fink, 2020

3

express existence and the feeling of touching [2] which differentiate from others visual display on interaction.

## 2.2. Gesture-based Communication

Gesture is a movement of part of the body, especially a hand or the head, to express an idea or meaning (Oxford Dictionary). Gesture is primitive language of human before knowing words. People can interact and communicate just by using gesture. For some extent, gesture can bridge the interaction between people. Several works shown how gesture based communication can bridge the interaction between people.

One study that approach the gesture-based communication is by Maurer et al. [10]. The study examine the use of hand gesture in game communication. Exploring the scenario of gesture as the only channel to communicate between user. According to the exploration study, it was indicated that the use of gesture enriched the interaction between user during the gameplay.

VIDEOPLACE [11] is one of the research that embracing gesture to create common communication stages for people who are separated. VIDEOPLACE





Figure 2.4 PORTAL instalation. Credits: BBC News, 2021

4

enabled people to see their appearance projected in real-time on a video screen. The image projected were in a form of silhouette. Another people could be summoned to the video screen allowing remote interaction experience. The interaction experience, enabling people to interact via gesture.

One works that embraces gesture to connect people is PORTAL. PORTAL is a public installation founded by Benediktas Gylys [12]. The installation facilitates real time communication between people from two separated locations. The installation are constructed with a large video image display and a camera. PORTAL relies heavily on the video image display and decides to not involve audio for communication in order to promote gesture interaction. By promoting gesture only communication, PORTAL aims to connect people by overcoming the social and language barrier in communication. As a result, people from two separated location could express themselves through unique gesture communication without worrying the social and language barrier. Some examples of the unique expressions are dancing, random body movement, waving hands and doing performance art.

Another works of gesture-based communication that connects people is Coca-Cola Small World Machines project. Coca-Cola Small World Machines is an installation project located in two different countries (India and Pakistan) [13]. The installation project aims to connect the people from both countries who are having conflicts in the past. The installation are constructed in a form of vending machine which consist of a large video image display and a camera. The main differences with PORTAL is the video image display in Coca-Cola Small World Machines featured a visual guide to trigger the interaction. Some of the triggers are waving hands together, touching the screen together, drawing a shape together, dancing together, etc. The result from the installation are as expected. People from two different countries experiencing the connections even without speaking any words.

Moreover, gesture also not only use to deliver the messages in interaction between people. Gesture are facilitating people to explore their body movement. For example in *Recollections* by Ed Tannenbaum, 1981 [14]. *Recollections* is an installation that encourage people to explore their gesture in creating visuals displayed on the wall. The works facilitate fun experience for participant to translate their bodily expressions into poetic motion.

## 2.3. Anonymous Communication

Anonymous communication is an interaction that hides the communicating participants. Anonymous communication may help people to reduce the feeling afraid of talking with strangers. The anonymity gives people ability to be more confident without the fear of rejection (Wylde 2020) [15].

There are many interesting works that embrace the anonymity in interaction between people. *Sexy Beast* force strangers to interact anonymously by hiding their face through heavy make-up and prosthetics [16]. Aiming to encourage

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4 source: <https://youtu.be/TRvbxjCj79E> accessed on July 27, 2021

5 source: <https://www.exploratorium.edu/exhibits/recollections> accessed on July 27, 2021



Figure 2.5 Recollections by Ed Tannenbaum, 1981. Credits: Exploratorium

5

strangers to focus on the conversation attraction rather than physical attraction.

There are several services on the internet that facilitate anonymous communication. One of the services that embrace anonymity in remote communication is Omegle. Omegle is a platform where people could interact with random strangers in remote communication. Nowadays in the indefinite period of social isolation due to pandemic, Omegle has grown in popularity (Lorenz 2020). Omegle uses chat and video features for the conversation between anonymous strangers. According to Cyberpsychologist Dr Joanne Meredith, using Omegle could make people become less insecure and behave in ways they would not normally do [17]. The anonymity would make people view the remote communication world like a kind of game.

Various apps also offer services to chat with random strangers anonymously in remote communication. Connected2.me is one of the examples. Connected2.me relies on video and picture sharing features for anonymous strangers [18]. When a user opens the app, it will display some people's profiles whom the user can chat with directly. Users do not need to show their identity; instead, they need to create stories through video or photo sharing. Strangers will be presented by what video

or photo they have shared. The kind of method will encourage user to be less judgemental with stranger's appearance. Then, there is an app named Whisper by MediaLab.Ai, Inc. Whisper is another anonymous app that has aims to connect people based on their minds and behaviour. The app experience embrace user to post a text or random thought through pictures and texts. The app lets people to judge by their thoughts instead of their appearance. People could respond to the thoughts to make connection with strangers. According to Tech Wiser, most Whisper user were having meaningful interaction with strangers and bring positive impact to their minds and behaviour [19].

## 2.4. Summary

Shadow visuals, gesture-based communication, and anonymity are three elements that could foster interaction between people. Many research has been explored the shadow potentiality as medium of interaction in face-to-face scenario. Therefore, this research aims to implement the shadow potentiality into remote communication scenario.

This research believes that those three elements could tackle the challenges of interacting with strangers in remote communication. Some challenges such as conversation enjoyment, conversational skills and the awkwardness. To sum up, this research aims to propose a way to interact with strangers in remote communication by utilizing shadow.

# Chapter 3

## Hello Shadow

### 3.1. Concept

This research proposed Hello Shadow, a concept of interaction between strangers in remote communication using gesture communication through shadow visuals. Hello Shadow facilitates interaction where people's appearance translated into a shadow visuals. Then, the interaction between strangers will happen anonymously via gestural exchange. Essentially, Hello Shadow are designed to tackle the challenges of feeling afraid of interacting with strangers in remote communication.

### 3.2. Design Process

The design process of Hello Shadow consisted of six main steps:

1. **Observation:** Observing the challenge people having on interacting with strangers in remote communication scenarios. Sketching several scenarios to initiate the primarily hypothesis.
2. **Literature review:** Reviewing the research and the work about similar studies. Examines the related field. As a result, three elements that could foster interaction between people were define.
3. **Ideation:** Ideation process consist of concept sketching and defining the use case.
4. **Prototyping:** Creating the prototype to challenge the concept.
5. **Discussion and evaluation:** Interviews and discussion were initiate in every stage of the design process. In order to collect valuable insight to support the design.

## 3.3. Ideation

### 3.3.1 Key Elements

Based on the literature review, the following three elements were defined to propose design solution:

- **Shadow visuals:** Shadow visual will limiting the information of people's appearance while still effectively deliver certain body information. The experience will create the connection via physical embodiment channel.
- **Gesture-based communication:** Gesture-based communication will bridge the interaction between strangers by facilitating the interaction enjoyment. The creativity of the gesture will spark the interaction.
- **Anonymity:** The design aims to tackle the feeling of afraid interacting with strangers. By provides anonymous communication, people would feel less insecure and behave in ways they would not normally do.

### 3.3.2 Concept Sketching

Noticing the three elements mentioned above, Hello Shadow aim to design remote communication platform that facilitate people to translate their appearance into shadow visuals. By translated into shadow visual, the communication will happen anonymously via gestural exchange. The design aims to facilitate people to do comfortable gesture-based anonymous communication.

Hello Shadow needs a system to translate people appearance into shadow visual. The idea is using a camera for input, translation system, and screen output to visualize the shadow.

In promoting gestural exchange, the interaction in Hello Shadow will not involve the audio and chat features. Therefore, the creativity of the user in creating body movement will determine the interaction enjoyment.

The concept was visualized into several sketches. Then, to gain insight from the potential user, the interview and discussion were conducted while presenting the concept sketch. In some discussion, people were excited with the idea in utilizing shadow to foster the interaction between strangers in remote communication. They expect the interaction between stranger will be unique since they will rely

on the gesture communication.

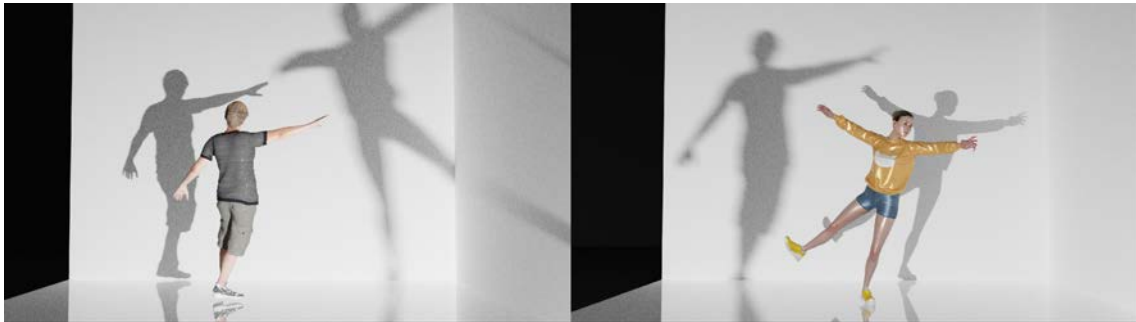


Figure 3.1 Concept Sketch: Envisioned interaction via shadow visual in remote communication

## 3.4. Scenario Design

To foster interaction in remote communication, target persona, scenario, and use case were defined. Creating target persona will help this research to highlight the advantage of Hello Shadow. Then, designing scenario will support to define the technology used for the Hello Shadow. Lastly, designing user flow will help in the creation of the Hello Shadow prototype.

### 3.4.1 Target Persona

This research focusing in proposing a way to foster interaction between strangers in remote communication. Study shown that the one whose having difficulty in interacting with strangers online is among young generation. Therefore, Hello Shadow aims to target young generation as the potential user. To define the target user, this research creates the persona as identified below:

The Shadow Player: This persona define the user who use the Hello Shadow platform. The shadow player is a person who looks for social interaction in remote communication but feeling afraid to interact with strangers. This person afraid that the interaction with strangers will not enjoyable. Moreover, this person worry about how to carry the interaction. They are afraid that the interaction will end

up being awkward. The value proposition of this user is to have a comfortable platform to interact with strangers without worrying the interaction enjoyment, insecure with conversational skills, and feeling awkward.

### 3.4.2 Scenario

Background: Experiencing the difficulty to interact with strangers in remote communication is common. Especially for people who are afraid to talk with strangers due to their insecurities.

Story: Bisma do the remote working spending most of his time isolated in the house. He live alone without his family. He wants to socialize with new people to gain his well being. Unfortunately, he has no clue how to initiate the interaction with new people online and afraid with the awkwardness situation.

He then decided to use Hello Shadow. Then a shadow visual of a person appear, trying to grab his attention. The shadow of strangers makes some funny and exciting gesture that steal Bisma's attention. He then decide to interact with that strangers by responding the strangers gesture. He creates another unique moves to spark the interaction. Suddenly, the fear Bisma having in interacting with strangers disappear. Bisma feel the connection with the strangers even though he can not see the stranger's appearance. The shadow visual facilitate the anonymity which makes Bisma feel comfortable to act they normally would not do in front of the strangers. The shadow communication method destroy his fear in interacting with strangers and destroying his invisible social barrier.

### 3.4.3 User Case

The interaction in Hello Shadow platform is real time communication in remote communication. The shadow visuals are the real time reflection of the user's gesture.

When user first enter the platform, Hello Shadow will provide a display so that user could see their appearance in shadow visual. The shadow display will help user observing their gesture and trying several moves. Moreover, this first step also help user to get ready for the shadow interaction with strangers. After observing their own shadow visual, user could start to find another user in the



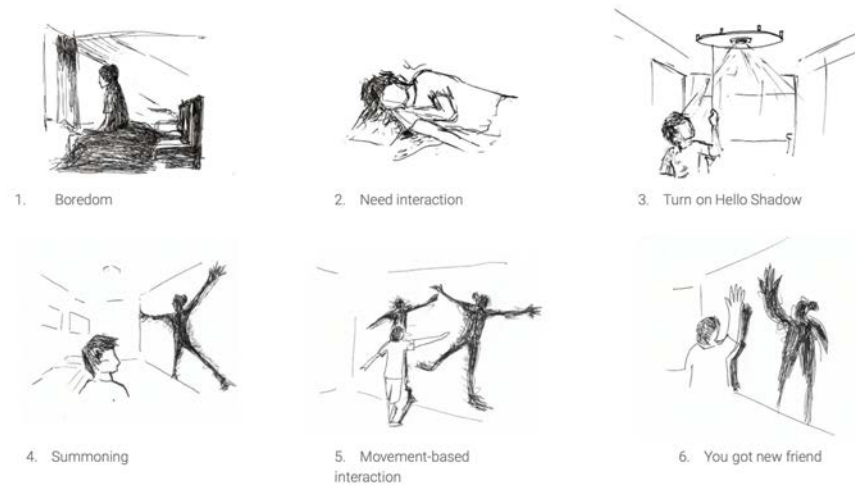


Figure 3.2 Scenario Sketch: Fostering interaction via shadow visuals

platform. They will decide who is they going to interact with. User will decide based on their observation with another user's shadow. Therefore, the creativity of the user's shadow will determine in initiating the interaction. The next step is match making. After both party agree to interact, they can interact freely using shadow formation.

#### 3.4.4 User Flow

To understand the moment of interaction in Hello Shadow, the user flow is divided into five phases such as:

- **Enter The Platform.**

Status: User still alone in the platform. Purpose: To let user explore their shadow visual and prepare for the interaction with strangers. Behavior: The shadow visual is a reflection of user's gesture.

- **Discovery.**

Status: Approaching another user's shadow to interact, Purpose: Stealing the

attention of other user's shadow. Behavior: User make unique gesture to grab attention from another user.

- **Yes or No.**

Status: User have to make a decision to interact with other user's shadow Purpose: Match making between user and strangers. Behavior: User deciding whose shadow they are willing to interact with.

- **Matching.**

Status: Both user and strangers are already decided to interact Purpose: Match making between user and strangers. Behavior: User getting ready to make 1 on 1 interaction via shadow visuals.

- **Interact.**

Status: Connected. Strangers shadow is summoned and ready to interact with user. Purpose: Free interaction via gesture. Behavior: User create gesture, utilizing their creativity to enrich the interaction.

### 3.5. Concept Summary

To sum up the initial concept, Hello Shadow is a platform that facilitate interaction between strangers via shadow visual in remote communication. The platform has three main features:

- **Shadow visualization for communication.**

The user appearance are translated into shadow visual. Shadow visual is real time to reflect the user existence which react depending on the user's gesture.

- **Gesture-based communication.**

This platform also promote communication via gesture. The user's creativity in creating gesture will spark the interaction.

- **Anonymity.**

The shadow visualization method of Hello Shadow helps user to hide their identity.

This research believes that shadow visualization will foster the interaction between strangers in remote communication because:

a) Shadow visuals delivers limited information about people's appearance while delivering certain body information. The condition will create unique interaction

experience of connected through the physical embodiment channel.

b) It promotes gesture-based communication. This condition will create same stage of communication between strangers.

c) It facilitate the anonymity. Shadow visual will hide user's face and identity. Tackle the insecurity while interacting with new people.

In order to test the initial concept, the prototype was made. The details of the prototype are described in the next section.

## 3.6. Prototype 1

The design of Prototype 1 have not represent the real interaction scenario of Hello Shadow in remote communication. Instead, the Prototype 1 aims to investigate the potentiality of shadow visuals in creating the feeling of connection through physical embodiment channel. Validating the shadow value in delivering limited information yet delivering certain body information to make the feeling of touching with others. Even though previous research has been validated that value of shadow, this research aims to investigate the value through primary data collection. In order to gain the understanding about shadow visual and gesture-based interaction in creating interaction enjoyment. Moreover, to define the technical implementation of Hello Shadow.

### 3.6.1 Prototyping

The devices used for the prototype 1 are personal computer, projector and Kinect <sup>1</sup>. Kinect is a motion sensor capturing device. The computer connect to the projector and the Kinect received the environment data to translated into shadow visual. The translation system is created by using TouchDesigner <sup>2</sup>. The hope of using Kinect for the prototype 1 is to facilitate more clear shadow and facilitate the whole body interaction for the user. The used of Kinect also facilitate the whole body interaction. The prototype 1 interaction will involve the space

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1 See Kinect: <https://www.youtube.com/watch?v=NK5qoTFRFmU>

2 See TouchDesigner: <https://derivative.ca>

surroundings. The shadow visual is projected into the wall using projector. Besides, this approach also aim to investigate if the shadow projection affects the interaction enjoyment between people.

The shadow visual is a colored shadow. This approach aim to explore the relation of shadow visualization with gesture in encouraging interaction enjoyment between people.

### 3.6.2 Initial test

To investigate the potentiality of shadow visuals in creating the feeling of connection through physical embodiment channel, initial test of prototype 1 was conducted. The test requires two participant to use the prototype. The participant were asked to interact freely using gesture via shadow visuals projected to the wall. Several findings were found from the initial test.

### 3.6.3 Findings

During the test, three participants were involved to do gesture-based interaction via shadow visuals. The interaction in prototype 1 involved user's whole body interaction. User were willing to play more with the body movement. Some of the participants involve not only their gesture but also their environment to spark the interaction.

The shadow projection on the wall provoked the participant's interest. Making them to be more curious to make some gesture. The participants tried to explore their shadow visual gesture. Several gesture created by the participants were captured.

During the interaction, some participants are captured laughing and trying to explained some words via gesture. However, for some limitation the shadow visual is not clear enough to describe the user's hand gesture.

Even though it have not validate Hello Shadow in real scenario which is in remote communication, the prototype 1 have shown promising of shadow visuals in creating interaction enjoyment between new people. For validating the value of Hello Shadow in fostering interaction between strangers in remote communication, prototype 2 was created.

## 3.7. Prototype 2

The prototype 2 aims to simulate the Hello Shadow platform in real remote communication scenario. The aim is to validate whether Hello Shadow could foster the interaction between strangers in remote communication.

The device use for the prototype 2 is personal computer, Zoom <sup>3</sup> application, and SnapCamera <sup>4</sup> application. The remote communication between user is facilitate with Zoom. Zoom is a video conferencing platform that facilitate one-on-one and group interaction. With video features, Zoom will become a powerful tools to create Hello Shadow prototype. Then to translate people appearance into shadow visuals, Snap Camera was used. Snap Camera is an application which facilitate user to apply filter while using their computer's webcam. Snap Camera offers many filter created by their community. In designing Hello Shadow prototype, the shadow visual used the Silhouette <sup>5</sup> filter created by Stephen Scully and Rainbow Silhouette <sup>6</sup> filter created by Ben.

### 3.7.1 User Test

The user test observe the potentiality of Hello Shadow in fostering interaction between strangers in remote communication. In the user test, the participant were asked to use prototype 2 to interact with strangers in remote communication using the shadow visual.

The user test requires the participant to turn their device then use Snap Camera on their Zoom application. Then, after the shadow visuals was ready, they

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3 <https://zoom.us>

4 <https://snapcamera.snapchat.com>

5 Credits: Silhouette filter by Stephen Scully <https://www.snapchat.com/unlock/?type=SNAPCODEuuiid=3383cb89dd044c7cb2900ab078ac17f3metadata=01>

6 Credits: Rainbow Silhouette filter by Ben: <https://www.snapchat.com/unlock/?type=SNAPCODEuuiid=1e97cfb2200f4f8496cb37598ee4a50cmetadata=01>

7 source: <https://play.google.com/store/apps/details?id=us.zoom.videomeetingshl=engl=US> accessed on July 27, 2021

were asked to interact with strangers. In order to observe the the shadow potentiality in fostering interaction between strangers, not many instruction were given to the participant. The participants could interact freely using shadow visuals. Moreover, giving the freedom of interaction aims to capture the genuine behavior as well as to observe the interesting activities to do together in gesture-based communication.

The initial test record the behaviour of the user when interacting with stranger's shadow. The user test was conducted three times with six different participants. Some of the participant were founded showing curiosity and excitement in interacting via shadow visuals.

However, It is observed that some of the participant feel difficult to recognized the shadow gesture of the strangers. This difficulty were shown when some participants trying to make hand gesture to interact. The limitation of the web camera device to capture the gesture movement and then translating into shadow visual is one of the reason.

Moreover, the user test session also explored the effect of interaction in colored shadow visual. Most of the participants showed a real excitement to see themselves in colored shadow visual. Colored shadow visual somehow trigger the participant to explore their gesture interaction.

#### Findings

The initial user test encourage the hypothesis that shadow visual could tackle the challenges of interacting with strangers in remote communication. It is shown that shadow visual could be an interesting media for the user to interact with strangers through gesture and anonymity. The participant's input from the initial user test will become a starting point in designing Hello Shadow.

Several insight from the initial user test were highlighted as below:

- **Clarity:** It was noticed that the participants were expecting more clear shadow visual to express their gesture clearly.
- **Color:** The color features of shadow encourage user to play more with their gesture.
- **Limitation of the interaction:** the gesture interaction in the first prototype are still limited to the upper body.

## 3.8. Refined Design Summary

The prototype 1 and prototype 2 are created to demonstrate and to explore the potential of Hello Shadow. Even though the prototype was not have the complete design of Hello Shadow, the initial user test of Hello Shadow in fostering interaction between strangers in remote communication shows promising result. However, there is still technical concern that need to improve for future development.

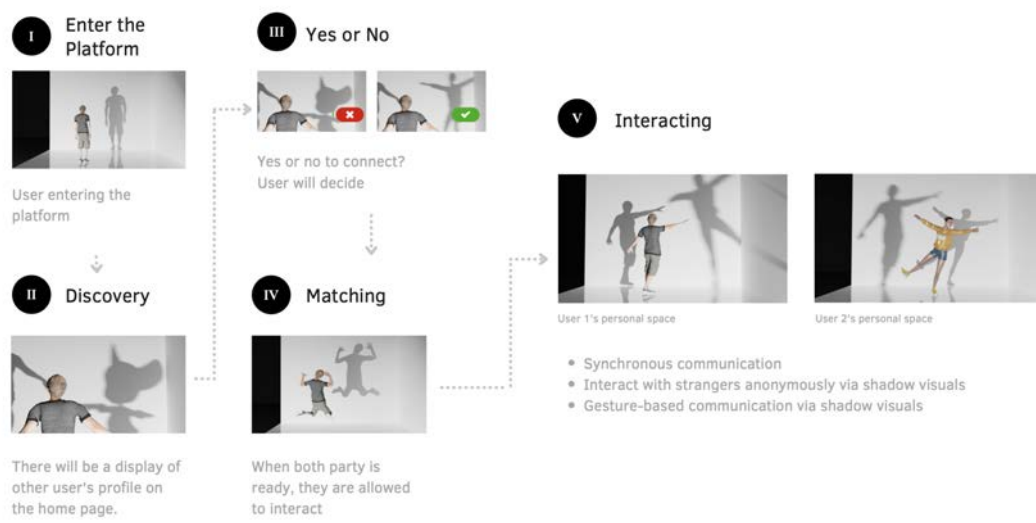


Figure 3.3 Uses cases





Figure 3.4 Prototype 1 building

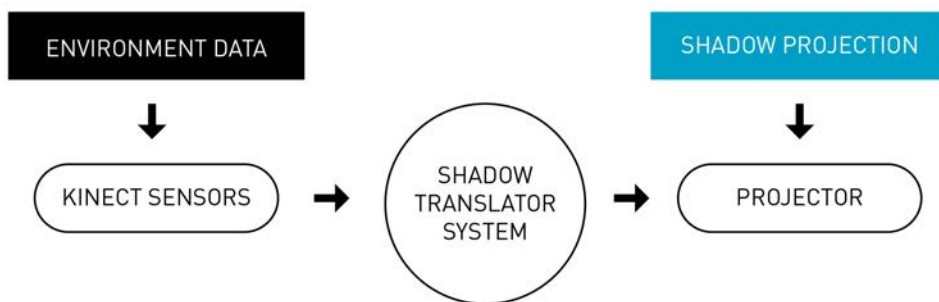


Figure 3.5 Scheme of shadow visuals system

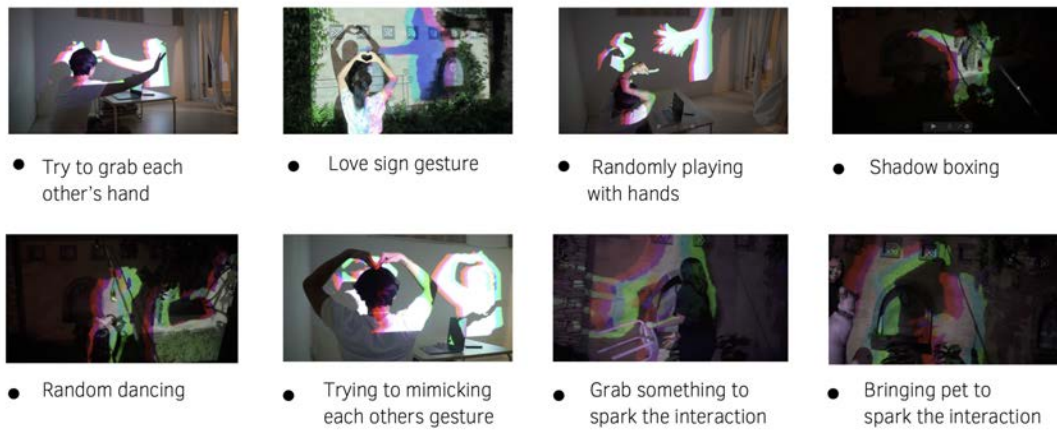


Figure 3.6 Several unique gesture were captured during the prototype 1 test



Figure 3.7 Envisioned interaction of shadow visuals



Figure 3.8 Zoom application for video conference

7



Figure 3.9 Silhouette filter created by Stephen Scully in Snap Camera



Figure 3.10 First prototype of shadow interaction using Zoom platform

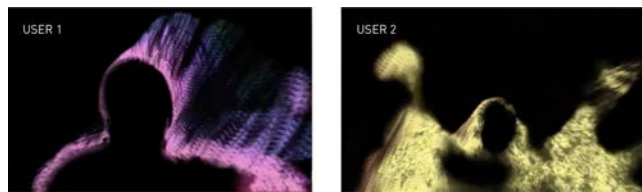


Figure 3.11 Testing the color features of shadow. Filter credits: Ben

# Chapter 4

## Evaluation

Hello Shadow is designed as a unique communication experience using shadow in remote communication. The main purpose of Hello Shadow is to overcome some challenges people having when interacting with strangers for the first time. Some challenges are interaction enjoyment, lack of conversational skills, and the awkwardness.

The previous chapter has explained the concept, design process, ideation, scenario, and the prototype design of Hello Shadow. During the design process, several user test was initiated in order to collect primary design validation. However, a further evaluation is necessary to examine the Hello Shadow in tackling the challenges of interaction with strangers.

### 4.1. Methodology

Since this research are aiming to tackle the challenges of interacting with strangers in remote communication, it is important to validate Hello Shadow design through experiment in real scenarios.

The advantage of Hello Shadow are examined related to Hello Shadow's main features: shadow visualization, gesture-based communication, and anonymity. To validate the features as a solution to tackle the challenges of interaction between strangers, several criteria were define:

- The interaction is facilitating less awkward interaction between strangers.
- The interaction is creating the interaction enjoyment between strangers.

The type of data that measured in the experiment is qualitative data. The data was collected through the user test, interview, and discussion. The experiment

will let the participants to freely try the prototype in order to observe interaction between strangers as spontaneous as possible. Moreover, to collect more insight related to Hello Shadow potentiality, this research observe every user behaviour in the experiment.

## 4.2. Experiment Settings

The scenario use of Hello Shadow is when people want to interact with others in remote communication but feeling afraid to initiate the interaction with strangers. Therefore, the experiment will simulate the scenario uses in order to validate the advantages of Hello Shadow.

The objective of the experiment is to evaluate the potentiality of Hello Shadow in fostering interaction between strangers in remote communication. The experiment will mainly use the prototype 2 of Hello Shadow due to it facilitate the same manner in scenario use. Therefore, the device used in the experiments were personal computer, Zoom, and SnapCamera apps to facilitate the shadow visuals interaction. In creating shadow visuals, the experiment use the Silhouette filter created by Stephen Scully and the Rainbow Silhouette filter created by Ben in SnapCamera apps.

To execute the experiment two participants required to interact using the shadow visuals. The interaction situation is one-on-one between strangers. It is crucial that the participants have not know each other before the experiment. Since the experiment is conducted remotely, each participants were asked to prepare the experiment device (personal computer, Zoom, and Snap Camera). The facilitator was guiding the participants to prepare the device and helping them if they have any problems in the preparation. The facilitator will create a room in Zoom for the platform of interaction.

The experiment consist of two session. The duration of the every session is three minutes. Before the experiment session, the facilitator make sure each participants were ready to interact in shadow visuals. After both participant ready, the experiment session will be started. In the session, the facilitator gave each participant freedom to interact via shadow visuals.

In order to observe the participants behaviour, the experiment was recorded.

Video record system was used from the beginning until the end of the experiment. The discussion were occurred after every session of the experiment to collect the qualitative data from the participant. The participant were asked to share their experience towards session. Every small gesture the participant made were observed in order to gain more insight. To validate more the advantage of shadow in fostering interaction between strangers, the experiment also conduct a comparison experiment between interacting via shadow visual and via conventional video.

Moreover, there is an ambition to test the shadow visual in group of strangers situation. For the group of strangers situation, the experiment setup and scenarios was similar with the one-on-one interaction. The interaction between group of strangers involved five participants.

### **Experiment Participants**

There were seven participants involved on the experiment in total, five male and two female. The age was varied between 21-28 years old.

### **Experiment Situations**

The experiments conducted in two situations. The first situation is one-on-one interaction between strangers. Second situation is interaction in a group of strangers.

### **Key Elements**

The keys element for the Hello Shadow experiment are:

- Strangers: The participants of the experiment is strangers in order validate the Hello Shadow value in fostering interaction between strangers.
- Remote communication: The experiment is conducted in remote communication scenarios in order to observe Hello Shadow in real situation.
- Shadow visualization: The participants will interact via shadow visualization only in order to validate the value of shadow in creating common grounds of communication.



Figure 4.1 Group strangers interaction using shadow visual

- Gestural-exchange: The participants will interact via gesture only to validate that gesture-based communication will facilitate enjoyable interaction between strangers.
- Anonymity: The identity of the participant will be hidden during the experiment. It was crucial to not reveal the identity of the participant in order to observe the value of anonymous interaction.

### 4.3. Test and Results

The experiment aimed to evaluate two aspects of Hello Shadow. These aspects are the assessment of shadow visuals and the advantage of Hello Shadow in fostering interaction between strangers in remote communication. For the advantage aspect, the criteria of the evaluation are whether the interaction is facilitating less awkward, enjoyable, and offers comfortable interaction between strangers. The experiment findings are described below:





Figure 4.2 Group of strangers shadow interaction



Figure 4.3 One-on-one interaction using shadow visual

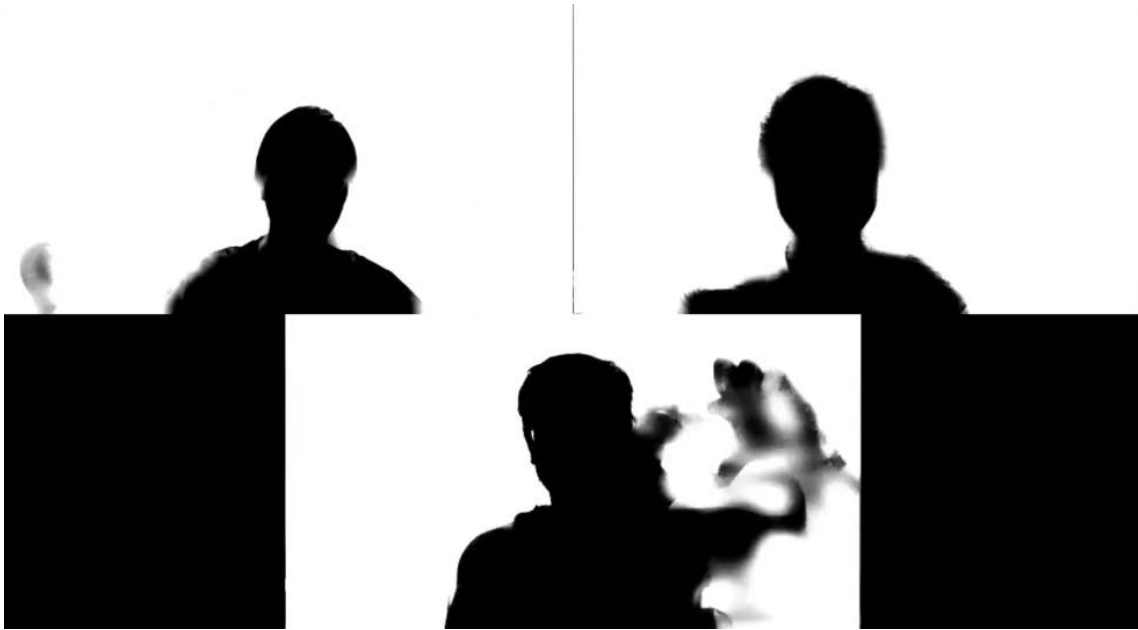


Figure 4.4 Participant expression via shadow visuals

### 4.3.1 Assessing the Shadow Visual

Shadow visual in Hello Shadow is designed to limit people's appearance while delivering certain body information to express the connection via physical embodiment channel. In the experiment there were two type of shadow visual assessed, the black and white shadow visual and the immersive colorful shadow visual.

It was observe that the two types of visual affect different behaviour of the participants. For the black and white shadow visual, participant tend to communicate through hand gesture. The black and white shadow visual force the participant to be more creativity in creating self expression.

However for the colored shadow, the participants are more involving their whole body to do self expression. It is also due to the particle effect created from of the shadow visuals which encourage participant to explore more. Some of the participant mentioned that immersive shadow visual was exciting to explore our expression via gesture however it somehow distracted them from the interaction with strangers. The participants are more exploring about their gesture rather than observe the reaction from others participant.

From both shadow visuals used, most of the participant were mimicking each other gestures. They tend to react based on what their partners react. These interaction that there is a value of communication happens even though its only ambiguous gestural exchange via shadow visuals.

### 4.3.2 Gesture observation

Since Hello Shadow is rooted in gesture communication, observing user's gesture within the experiment is crucial.

Therefore, some unique gesture behaviour during the experiments were captured.

- Mimicking other participants
- Observing other gesture and reacting to it
- Trying to grab each other's hands
- Interact via hand gesture.
- Waving hands
- Trying to introduce themselves with hands
- Creating love sign with hands
- Mocking with hands
- Involving body to interact
- Dancing
- Moving around the room
- Doing random movements
- Fighting gesture
- Doing shadow boxing

### 4.3.3 The Advantage of Hello Shadow

In the experiment, it was confirmed that Hello Shadow has certain value in fostering interaction between strangers in remote communication. Shadow visuals could offers unique interaction experience between strangers in connecting via through the physical embodiment channel. The limitation of appearance tend to create some exciting experience for the participants. Some participants were

captured guessing each other's gesture. Trying to observe their partner's messages via shadow visuals. The limitation was challenging yet interesting for some participants. It creates the gamification experience for the participants.

The gesture-based method communication in Hello Shadow force participants to be more creative and playful to spark the interaction. This validate that Hello Shadow could facilitates interaction enjoyment among strangers. The promotion of using gesture also create an awkwardness free interaction. In some session, there is some participant from different countries. Since the communication is not involving the audio to speak, the participants were communicating through gestures. Some of the participants are trying to introduce themselves with hand gestures.

Moreover, the interaction via shadow visuals facilitate comfortable anonymous communication for some participants. Since the participants could hide their face and their identity, the interaction are become less awkward. Some user mentioned that the method were comfortable for them to interact with new people since they often feel insecure when interacting with strangers. The shadow visual could unleashed their unexplored territory in a way they communicate. The shadow visuals also allowing them to explore body movement such as dancing, doing silly gestures, random movements, and many more. Something they would not normally do when interacting or meeting with new people at the first time.

By hiding the appearance and interacting via gesture, they feel less worried in carrying the interaction. They feel less stressful when doing interaction. Most of the participants feel it easier to interact via shadow visual with strangers. Compared with the conventional remote communication via video which make them feel awkward and having difficulty to carry the conversation. Some participants said that with shadow visuals, they do not have to worry about their hair, their attire, and the background display when interact remotely.

In a group situation session, the interaction between strangers happened to be more random and wild. Some participants felt that the group situation tends to give less awkward situation. The participants feel way less worry to carry the interaction since they can rely on others interaction.

It did not matter whose shadow the participant interact to, they will play without any fear of rejections. Some user mentioned such kind of experiment.

Moreover, they tend to mimicking each other's gesture more frequently. Some participants try to observe what gesture that other's made and then try to respond that gesture. The interaction happened to be exciting and playful for the group of strangers. Some participants even suggest that the kind of interaction may be more exciting to play game together.

The comments and discussion from the experiment were documented and highlighted as below:

### **Less Awkward Interaction**

The experiments aim to observe whether Hello Shadow could tackle the insecurity people having when interact with strangers. Hello Shadow aim to propose comfortable interaction between strangers which overcome the insecurity.

In the group situation, there are several moments when user create totally random gestures. Some participant said that

- "I feel less awkward interacting with people i just meet. I could overcome on my insecurities (my hair, my room, etc)."
- "During the experiment, It does not matter whose shadow I am interacting to, I feel have full freedom to make gesture I like."
- "Its good for shy people like me, because we somehow hide our identity."
- "It can unleash my unexplored territory in way to communicate."
- "It gives more freedom to communicate with new people."

### **Enjoyment of the Interaction**

The experiments aim to observe the Hello Shadow values in proposing the enjoyment interaction between strangers.

- "The most interesting part (of the interaction) is the limitation of the way we communicate. We translate, we try to understand what others saying, that was challenging yet interesting communication experience."
- "I try to guess more about what others saying with their gesture."
- "I feel like having superpower."
- "The gesture kind of shows up the personality, that might be helpful to know strangers."

- "The interaction is like playing game."

# Chapter 5

## Conclusion

Initiating the connection with strangers in remote communication might be challenging for some people. One of the challenge is due to the feeling of afraid with strangers. To tackle the challenge, this research proposes Hello Shadow.

Hello Shadow proposes a unique way to foster the interaction with strangers in remote communication. The way to foster interaction between strangers is by promoting ambiguous gestural exchange through shadow visuals. The ambiguous gestural exchange through Hello Shadow will initiate conversation enjoyment, awkwardness free interaction, and set comfortable self expression for strangers interaction.

The concept of Hello Shadow was evaluated several times through user experiment. The goal of the experiment was to validate the Hello Shadow values in tackling the challenge of fear with strangers. However, based on the experiment the limitations of Hello Shadow are founded. The discussion from the experiment leave room for future improvement.

### 5.1. Limitation

According to the experiment and the observation, Hello Shadow has shown its potentiality in tackling the challenge of afraid with strangers. However, there is some limitation found from the experiment. The first limitation is, it is unclear what is the next step of strangers after successfully interacting via Hello Shadow. Second, the experiment have not tested the duration factors of the interaction between strangers. These limitation leaves a questions for further research.

## 5.2. Future Works

The experiment leaves technical feedback for Hello Shadow. According to some feedback, the shadow visual need to clearly reflect user's gesture. The clarity of the shadow is important for some user. In this context, exploring the technology with less friction to make the shadow effect more clear is necessary.

### 5.2.1 Broaden the Context

The several experiment shows the shadow potential in fostering interaction between strangers in remote communication. This research believe that shadow visual has certain value in connecting people in remote communication.

Based on the experiment and the discussion with the participants, the shadow visualization opens up many possibilities to broaden the interaction scenarios. Some discussion found that, It is suitable to adapt the Hello Shadow interaction method into another scenarios such as conference ice-breaking, online party, school event, company family gathering, blind dating, etc. Therefore, there is an ambition to expand Hello Shadow values into more scenarios.



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